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Associated pathways between neighborhood environment, community resource factors and leisure-time physical activity among Mexican-American adults in San Diego, CA

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Abstract

Purpose—To examine pathways between individual, social, and environmental factors associated with leisure-time physical activity (LTPA) among Mexican-American adults.

Design—Cross-sectional design using random digit dialing to administer a structured telephone interview.

Setting—Mexican-American adults living in a U.S./Mexican border community in San Diego, CA (N=672).

Measures—Data were collected on LTPA, demographic characteristics, acculturation, and other psychosocial and environmental factors associated with LTPA.

Analysis—Structural equation modeling to test an a priori model of LTPA.

Results—Participants were mostly female (71%) with a mean age of 39 years (SD = 13). Only 32% of participants met PA guidelines in their leisure time, with men (39%) meeting the guidelines more than women (29%). Using structural equation modeling, neighborhood factors, both social and environmental, showed indirect relationships with meeting PA guidelines through community resource factors. Significant covariates included marital status and age.

Conclusion—Individual, social and environmental factors were associated with LTPA in this sample of Mexican-American adults. These findings can inform intervention studies that aim to increase LTPA in this population.

Keywords

Physical activity; Latino; acculturation; social-ecological model; research; modeling/relationship testing; survey research; behavioral; community; fitness/physical activity; built environment; culture change; adults; suburban; Latino/Hispanic

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INTRODUCTION

Latinos, the largest U.S. ethno-racial group, report the lowest amounts of leisure-time physical activity (LTPA).[1] Only 26% of Latinos currently report meeting *2008 Physical Activity Guidelines for Americans* in their leisure time compared with 38% of non-Latino Whites.[2] As a result, Latinos may not attain the benefits associated with LTPA such as decreased risk of obesity,[5] chronic diseases,[3] and improved mental health.[4] It is a public health priority to understand what promotes or hinders LTPA in Latino communities.

The Social Ecological Model posits that physical activity (PA) behaviors are influenced at multiple levels including but not limited to the social and built environments.[5] There is, however, a paucity of research on whether this model is useful in understanding behaviors in a variety of ethno-racial and cultural groups.

Self-efficacy and social support are well established correlates of LTPA in the general population and among Latinos, with studies showing self-efficacy to be a mediator between PA social support and LTPA.[6] Other social cognitive factors, however, explain little variance in LTPA,[7] highlighting the need to examine these variables in the larger context of LTPA.

Given the importance of culture and cultural changes experienced by immigrants, it is worthwhile to examine socio-cultural factors such as acculturation in studies of PA among Latinos. Acculturation, the psychological and behavioral changes that occur with exposure to a new culture,[8] is shown to be associated with the adoption of unhealthy dietary[9] and substance-use behaviors.[10] Acculturation plays a role in PA;[11] however, given the importance of context in the cultural change process, studies are needed to examine this relationship using a social ecological approach.

Social cohesion plays a salient role in outdoor PA among the broader population,[24] and perhaps this is true for Latinos as well.[12] Latinos are characterized as highly collective;[25] therefore, social ties may help to overcome environmental barriers (e.g., crime) to being physically active within one's neighborhood. Also, Latinas identify numerous barriers to PA including lack of parks near home and lack of knowledge about community programs.[16] Thus, it is possible that neighborhood cohesion increases community resource use by increasing knowledge about where and how to be active.

Environmental characteristics, perceived or objectively measured, are associated with PA including those that facilitate leisure-time walking such as street-lights and crosswalks.[13] Few studies in Latino communities have concurrently examined individual-, social- and environmental-level factors.[14, 15] Moreover, to our knowledge, there is no published evidence on the relationships between neighborhood safety and PA in the Latino population despite evidence that neighborhood poverty, lack of parks near home and insufficient knowledge about community programs have been identified as environmental barriers to PA.[16]

PURPOSE

Based upon this background, the current study developed and tested an explanatory social ecological model of PA among Mexican-American adults living on the U.S.-Mexico border in San Diego, CA. We used structural equation modeling to allow for rigorous, simultaneous examination of individual-, social- and environmental-level factors and LTPA (see Figure 1). We hypothesized a mediated relationship between PA social support and LTPA through self-efficacy. Due to limited literature, we also hypothesized the following: (1) acculturation would be positively related to LTPA; (2) neighborhood cohesion would mediate the

relationship between neighborhood safety (i.e., barriers, facilitators) and LTPA; and (3) community resource factors (i.e., use, awareness, and satisfaction) would mediate the relationship between neighborhood cohesion, neighborhood safety and LTPA.

METHODS

Design

This study used cross-sectional data obtained from the CDC-funded core research project of the San Diego Prevention Research Center (SDPRC), a community program to promote PA in a Latino community.

Setting and Participants

In 2006, the SDPRC conducted an interviewer-administered structured telephone interview in two San Diego communities near the U.S./Mexico border, with a predominantly Mexican-origin population. Adults 18- to 65-years old were contacted to complete an interview in either English or Spanish. Using random digit dialing, 38% of those called responded and 62% of those who responded completed the interview, resulting in a sample size of 672. The study was approved by the IRB offices of San Diego State University and University of California, San Diego.

Model

A model for LTPA based upon theory,[5] and relevant literature[14, 15] was developed to explore relationships between individual, social and environmental correlates of PA. The model also allowed for evaluation of whether these relationships held true when controlling for gender, years living in the U.S., and marital status.

Measures

Prior to data collection, culturally appropriate methods (e.g., pilot-testing, forward and backward translation, pilot-testing) were applied to enhance the interview's performance in the target population.[17]

Dependent Variable—LTPA was assessed using the International Physical Activity Questionnaire (IPAQ).[18] The IPAQ measures PA habits in different domains (work, chores, transportation, leisure) and sedentary behavior and the current study focused specifically on LTPA. The IPAQ has shown excellent test-retest reliability (0.80) and validity.[18] Participants were asked: "During the last 7 days, on how many days did you do moderate [or vigorous] PA in your leisure-time for at least 10 minutes"; and "How much time was usually spent on one of those days doing moderate [or vigorous] PA during leisure time?" PA data were skewed and could not be transformed to meet statistical assumptions. To examine the data with public health relevance, participants were categorized as meeting PA guidelines if they engaged in one of the following: ≥ 150 minutes of moderate-intensity PA, ≥75 minutes of vigorous-intensity PA, or ≥150 minutes of moderate- and vigorous-intensity PA per week. Not meeting PA guidelines was coded as a 0, whereas meeting PA guidelines was coded as a 1.

Individual-level Factors

Self-efficacy: Three items, selected from a PA self-efficacy scale,[19] were translated from English to Spanish by bilingual/bicultural research assistants and members of the investigative team, and showed good internal consistency (α=0.77). Participants were asked to assess their confidence for engaging in PA in various situations. Response options ranged

from *I'm sure I cannot* (1) to *I'm sure I can* (5). In the confirmatory factor analysis (CFA), the three items loaded on a single factor (factor loadings between 0.70 and 0.83).

Community Resource Awareness: Several scales were developed to assess perceptions of PA support in the physical environment.[20] One set of three items assessed knowledge of places and ways to engage in PA in the community, with response options ranging from *strongly disagree* (1) to *strongly agree* (4), with a higher score indicating greater awareness of community resources. These items have been tested for internal consistency (α=0.73), and have been assessed for test-retest reliability and validity (κ = −0.07 to 0.25 and ρ = 0.28 to 0.56).[20] CFA identified one single construct, with factor loadings between 0.60 and 0.68.

Community Resource Satisfaction: One item assessed participants' satisfaction with the number of parks, trails and other outdoor recreational areas in their community. Response options ranged from *strongly dissatisfied* (1) to *strongly satisfied* (4), with a higher score indicating greater satisfaction.

Community Resource Use for PA: Participants were asked to report their usual monthly use of outdoor recreational areas for PA. A mean score was calculated for average monthly use of outdoor parks and recreational facilities.

Social-level Factors

Social Support: Social support from friends was assessed with three items from a six-item PA social support scale.[21] The measure was translated from English to Spanish, and showed good internal consistency (α=0.78). Respondents were asked how often they received PA social support from friends. Response options ranged from *never* (1) to *very often* (5). In the CFA, the three items loaded on one single factor (factor loadings between 0.70 and 0.89).

Acculturation: Two proxies of acculturation were examined in this study. First, we used number of years living in the U.S. (<12 years [1] vs ≥12 years [2]) previously used as a proxy of acculturation.[22, 23] A measure of acculturation included eight items from the Short Acculturation Scale for Hispanics (SASH).[24] The SASH scale is deemed an appropriate scale for Mexican-Americans (α=0.92 and ρ=0.52 to 0.76). Respondents were asked what language they spoke or used for reading, speaking, watching and listening to media. Responses included *only Spanish* (1) to *only English* (5), with a higher score indicating a greater degree of English language use. In the CFA, six items best described language acculturation (factor loadings between 0.75 and 0.90). The two items regarding acquaintances' ethnic background did not load on the construct.

Neighborhood Cohesion: Six items from a neighborhood cohesion scale assessed degree of neighboring (having common boundary) and sense of community.[26] Response options ranged from *not at all true* (1) to *very true* (3), with a higher score indicating greater neighborhood cohesion. The items were reliable (α=0.71) and the scale was available in Spanish. In CFA, four items loaded on one construct (factor loadings between 0.51 to 0.64). Items about neighborhood disorder (e.g. drugs, theft) did not load on the construct.

Environmental-level Factors

Neighborhood Safety (barriers): Four items from the Neighborhood Environment Walkability Scale (NEWS), were used to assess perceptions of neighborhood barriers to walking (e.g., heavy traffic, crime, and stray dogs).[27] Response options were based on a Likert scale, and ranged from *strongly disagree* (1) to *strongly agree* (4), with a higher score indicating fewer barriers in the environment (α = 0.83). In the CFA, neighborhood barriers were well described by these items (factor loadings between .33 and .66).

Neighborhood Safety (facilitators): Four items from NEWS assessed participants' perceptions of factors that facilitated pedestrian safety in the neighborhood (e.g., street lighting, availability of crosswalks, and pedestrian visibility).[27] Response options ranged from *strongly disagree* (1) to *strongly agree* (4), with a higher score indicating a safer built environment ($\alpha = 0.77$). In the CFA, neighborhood facilitators also were well described by these items (factor loadings between 0.43 and 0.57).

Covariates: Individual-level characteristics included gender (male [0] vs female [1], age, married/living as married [0] vs single [1], employment status (unemployed [0] vs employed [1]), and monthly household income (≤$1500 [1] vs >$1500 [2])

Statistical Analysis

Initial analyses were performed using the Statistical Package for the Social Sciences for Windows Version 15.0 (Chicago, IL). Descriptive data were generated for all variables, and *t*-tests were conducted to test gender differences in meeting PA guidelines.

Prior to structural equation modeling, CFA was performed to confirm factor structures of latent constructs. Factor loadings were significant at $p \leq .05$.

The proposed model (see Figure 1) with latent constructs was examined using Mplus software (Muthen & Muthen, Los Angeles, CA). Overall model fit was determined using Chi-square statistic, with a $p > 0.05$. Model fit indices for a categorical dependent variable included comparative fit index (CFI ≥90) and root mean square error of approximation (RMSEA approximating .06).[28] The parameter estimates, standard errors, t-statistic, and squared multiple correlations were inspected for sign and/or magnitude. Pathways were significant at $t>1.96$.

The initial sample size (N=672) was reduced to 668 due to missing data and outliers on self-reported PA. Outliers were determined by the IPAQ standard (exclude cases where the sum total of all PA exceeds 16 hours/day). Maximum likelihood was used to account for missing data.[29]

RESULTS

Study sample characteristics are summarized in Table 1. Means and standard deviations for observed variables are in Table 2. Participants were predominantly female and, on average, 39 years of age. Most participants were classified as less acculturated, but had lived in the U.S. for an average of 19 years. Less than half of the participants had at least a high school education/equivalent, nearly half were employed, and more than half earned a monthly household income >$1500. Nearly one-third of participants adhered to *2008 Physical Activity Guidelines for Americans* in their leisure time (see Table 2), with men more likely to adhere to the guidelines than women.

Structural Equation Modeling

The model (Figure 2) showed relationships between individual, social and environmental factors and meeting LTPA guidelines ($X^2 = 145.2$, $p > 0.05$; CFI = .97; RMSEA= .02). Neighborhood barriers was related to neighborhood facilitators (B= .65), which was indirectly associated with meeting LTPA guidelines through several mediators: neighborhood cohesion and community resource satisfaction (B= .32, B= .49, respectively). Both neighborhood cohesion and community resource satisfaction showed an indirect relationship with meeting LTPA guidelines through community resource awareness (B= .32, B= .58, respectively). The relationship between meeting LTPA guidelines and community

resource awareness (B= .25) was mediated by community resource use (B= .31). Also, being younger and being single were related to meeting LTPA guidelines (B= −.29, B=.11, respectively). The final model controlled for self-efficacy for PA, social support from friends, language acculturation, years living in the U.S., and gender. As these factors were not significant in the model, they are not shown in Figure 2. Monthly household income and employment status were not significant and removed from the final model for parsimony.

DISCUSSION

We used the Social Ecological Model to conceptualize and examine individual-, social- and environmental-level factors and LTPA. Contrary to the hypothesized positive association between acculturation and meeting LTPA recommendations, language acculturation and living in the U.S. showed no association. We confirmed our hypothesis that neighborhood cohesion and community resource factors (i.e., satisfaction, awareness and use) explained the relationships between neighborhood safety factors (i.e., barriers and facilitators) and meeting LTPA guidelines. Respondents perceiving greater environmental facilitators for PA were more likely to have more positive perceptions of neighborhood cohesion and community resource awareness and, in turn, more likely to use community resources to meet LTPA guidelines. Lastly, significant covariates in the model included age and marital status.

These findings relate to the *Healthy People 2010* goals and highlight the disparities in LTPA among Latino adults. Approximately one-third of participants achieved the *2008 Physical Activity Guidelines for Americans*, which is similar to other estimates of Latinos' adherence to PA recommendations.[30, 31] It was also estimated that 26% of Mexican-American adults reported meeting PA recommendations,[1] with women (*Latinas)* engaging in less LTPA than men.[22] Although gender was not a significant covariate in our a priori model, significant t-test findings showed this same trend between Mexican-American men and women. Perhaps gender was not a significant factor in our sample given that most participants were female. Nevertheless, the low levels of meeting LTPA guidelines in Latinas are well documented, and some health experts attribute the difference to socialized gender roles.[2, 24] Also, married (or living as married) participants were less likely to meet LTPA guidelines and, as in other studies,[13, 14] suggest that married individuals have responsibilities that hinder engagement in LTPA. Participants were mostly women. Thus, it may be that married Latinas are more likely to be responsible for household and family related activities (e.g., cooking, caring for family), thereby increasing the number of barriers to PA such as lack of time, energy and need for childcare.[15] It is well documented that PA decreases with age, and our findings echo these findings.[4]

Previous published findings on the relationship between individual- and social-level factors, such as self-efficacy for PA, social support from friends, and LTPA have been inconsistent. Although self-efficacy for PA was generally high, we did not find this association.[13, 14] Also, we did not find a relationship between perceived social support from friends and LTPA. Scale properties including a ceiling effect in self-efficacy may explain the former results. It is also possible that psychosocial factors are not as important for a population that is impacted by poverty and other social determinants.[32] Perhaps, other social- and environmental-level factors play a larger role in Latinos' PA, which are discussed below.

Greater time living in the U.S. has shown both negative[33] and positive associations with LTPA,[2] which we did not find. Also, language acculturation, as measured by the SASH, was not associated with LTPA. There may be several explanations for the lack of findings, including the extent to which variables of acculturation are relevant for this context. For example, there was little variance in language acculturation due, in part, to the study population's proximity to the U.S.-Mexico border. Dominant Spanish language use and

biculturalism (dominance of both the English and Spanish languages) are common in this area of the U.S.[34] Language acculturation, as opposed to time living in the U.S., may be a less relevant correlate of health behaviors in this population given that language acculturation is not occurring. There may be no need to become an English dominant speaker as language may be adaptive to the context as evidenced by this biculturalism. Also, in this context of border culture, time living in the U.S. may not reflect greater exposure to the norms and behaviors of the dominant culture. On the other hand, border populations, such as our participants, with only a high school education may have physically demanding occupations and family responsibilities,[35] which may both limit time and the perceived need for LTPA. Lastly, it is possible that some participants used walking for transportation. Engaging in these different forms of PA may have played a role in lower levels of LTPA. Another study in the same population found that nearly a third of participants met the recommended minutes of PA through walking for transportation.[36]

The key findings of the current study were the observed pathways between LTPA and environmental-level factors such as neighborhood characteristics and community resource factors. Previous focus groups of Latinas revealed that a lack of neighborhood safety is a barrier to PA;[12, 15] however, empirical studies do not show this relationship.[13, 14] These findings support an indirect association between perceptions of neighborhood safety (i.e., facilitators and barriers) and meeting LTPA guidelines. Participants perceiving fewer neighborhood barriers (e.g., crime, traffic and unattended dogs) perceived greater neighborhood safety facilitators for walking, bicycling and children playing. In turn, neighborhood safety may have facilitated opportunities for social interaction thereby resulting in greater neighborhood cohesion.[37] Additionally, participants perceiving greater neighborhood safety were also more satisfied with PA resources in their community.

Participants perceiving greater neighborhood cohesion and satisfaction with PA resources had more knowledge about how to be active in their community, greater use of outdoor community parks and recreational areas and were more likely to meet LTPA guidelines, confirming findings in other studies.[38, 39] These findings may be useful for interventions to promote LTPA. First, cohesive neighborhoods may contain more channels to disseminate health promotion information about where and how to be physically active. Second, neighborhoods with fewer safety barriers to and more safety facilitators for PA may have community parks and recreational areas with similar characteristics making them pleasurable and safe to use. Future studies should consider collecting measures of the built environment and using multi-level modeling to determine these associations with greater specificity.

Study Limitations and Strengths

This study is not without limitations, most notably telephone-administered interviews, which resulted in an overrepresentation of women in our sample. Also, we may have had an under representation of individuals without a home phone and cell phone-only users; however, a study on random digit dial telephone interviews showed that a 35% response rate is high.[40] Furthermore, the use of telephone interviews for research in U.S.-Mexico border populations has been validated with that of face-to-face interviews.[41] PA was quantified using a self-report that distinguishes between domains of PA, but recent studies using objective PA measures have found Latinos tend to under-estimate PA.[42, 43] We did not assess where participants engaged in LTPA. Finally, the cross-sectional research design limits the ability to infer causality.

The current study has several strengths, including structural equation modeling to examine multilevels factors on the PA of Latinos of a border community. We examined several acculturation measures given the dual importance of Mexican and U.S. culture in this border

population living in South San Diego County. These findings may be generalized to Latinos living along the U.S.-Mexico border and Southern California, and those who share their characteristics.

Conclusion

In summary, this study contributes to the growing literature on physical activity among Latinos, and sheds light on its individual, social and environmental correlates. PA promotion in Latino communities may benefit from increasing neighborhood safety that in turn leads to a sense of well-being, neighborhood cohesion and greater satisfaction, awareness and use of PA community resources. These findings may help to inform the promotion of PA by intervening at multiple levels of influence in Mexican-origin Latino communities.

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SO WHAT?

Many physical activity studies emphasize the importance of individual-level factors, with little focus on social- and environmental-level factors. This study is one of the first to use structural equation modeling to investigate multi-level factors thought to influence physical activity in Mexican-American adults of a U.S./Mexican border community. In this sample, neighborhood safety factors (environmental-level) were related to neighborhood cohesion (social-level) and community resource satisfaction (individual-level). In turn, these social-and individual-level factors were related to community resource awareness (individual-level), which associated with meeting LTPA guidelines through community resource use (individual-level). If our results hold true, health promotion researchers should aim to design community-wide interventions that target modifiable social and environmental-level factors to promote physical activity in similar populations. Furthermore, tailoring physical activity promotion based on age and marital status may be more effective than a “one size fits all” approach.

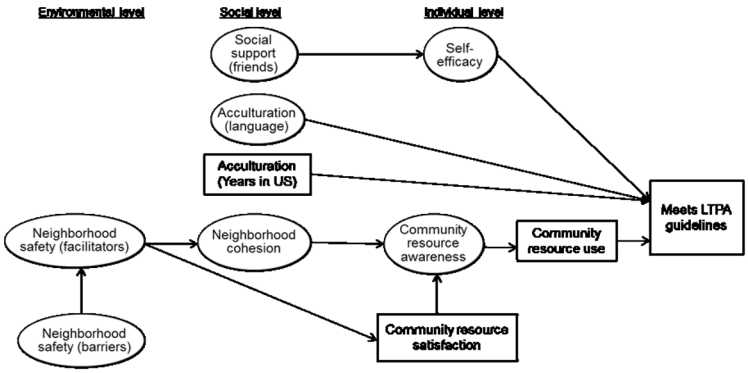

Figure 1.

Original model of individual, social and environmental level factors, and meeting PA guidelines

Circles represent latent constructs; squares represent oberved variables. Model does not include covariates.

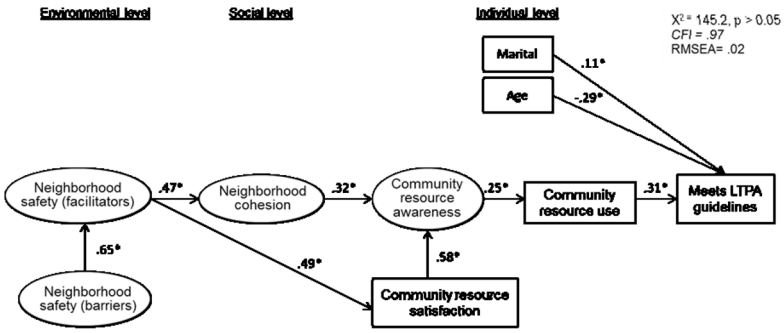

Figure 2.

Significant pathways between individual, social and environmental level factors, and meeting PA guidelines

*All pathways are significant at t-value > 1.96. Model fit was determined using X^2 test statistic, CFI (comparative fit index) and RMSEA (root mean square error of approximation).

Table 1

Demographic characteristics of Mexican-American adults (N=668) in San Diego, CA

	Total sample	Male	Female
Sample Size	668	191	477
Mean age (SD)	39 (13)	33 (10)*	46 (11)*
% Female	71	28.6%	71.4
% Prefer Spanish	58	45.5	63.3*
% Single	42	46.1	40.3
% Households with more than one child	46	36.8	49.7*
% More than a high school education	39	43.2	37.7
% Employed	46	50.8	44.5
% Monthly income > $1500	61	83.0	72.9*
% U.S. born	30	29.3	30.8
Mean years living in the U.S. (SD)	19 (12)	23 (13)*	18 (12)*
Mean acculturation score† (SD)	2.2 (9)	2.5 (0.9)*	1.9 (.8)*
% BMI ≥ 25	70.1	60.4*	76.3*

† Acculturation scores ranged from 1 to 5, with a higher score indicating greater English language use.

* Chi-square and t-test analyses significant at p≤ .05.

Note. % Monthly income is based on the total sample, including 20% of people who refused to answer this question; of those who responded, 75% lived > $1500/month.

Table 2

Prevalence of LTPA Differences and Health Parameter Estimates of Mexican-origin adults (N=668) in San Diego, CA

Parameters	Male	Female	Total
Sample size	191	477	668
% Meets recommended levels of LTPA	39.3*	28.7*	31.7
Mean self-efficacy for PA† (range= 1–5, SD)	4.1 (0.9)	3.9 (1.0)	4.0 (1.0)
Mean social support from friends† (range = 1–5, SD)	2.1 (1.2)	2.1 (1.1)	2.1 (1.1)
Mean neighborhood safety† (range =1–4, SD)			
Barriers	3.1 (0.7)	3.0 (0.7)	3.1 (0.7)
Facilitators	2.9 (0.8)	2.8 (0.8)	2.8 (0.8)
Mean neighborhood cohesion† (range = 1–3, SD)	2.5 (0.5)	2.4 (0.5)	2.4 (0.5)
Mean community resource awareness† (range = 1–4)	2.9 (0.8)	2.8 (0.8)	2.9 (0.8)
Mean community resource satisfaction† (range = 1–4, SD)	2.9 (0.9)	2.8 (1.0)	2.8 (1.0)
Mean monthly community resource use for PA† (SD)	7.8 (8.1)	7.5 (7.9)	7.6 ± 7.9

† Higher scores indicated greater self-efficacy for PA, social support for PA, neighborhood safety, neighborhood cohesion, community resource awareness, community resource satisfaction and community resource use, respectively.

* Chi-square and *t*-test analyses significant at p≤ .05.